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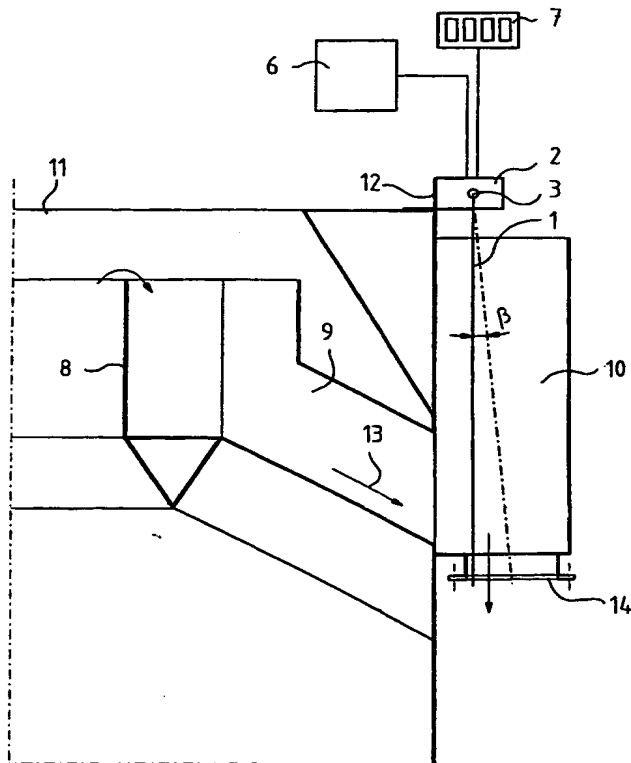
PCT

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**WO 01/01080 A1**

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B03B 13/00
- (21) International Application Number: **PCT/FI00/00553**
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991484 29 June 1999 (29.06.1999) **FI**
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- (81) Designated States (national): **AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW.**
- (84) Designated States (regional): Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).
- Published:  
— With international search report.

[Continued on next page]

(54) Title: **ARRANGEMENT FOR MEASURING CONCENTRATE FLOW IN CONNECTION WITH A FLOTATION CELL**



(57) Abstract: An arrangement for measuring material flow, particularly concentrate flow, in connection with a flotation cell. The arrangement comprises an elongate sensor element (1) extending essentially over the whole transversal area of the material flow to be measured, and a measuring device (2) for detecting the position of the sensor element (1).

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*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 00/00553

## A. CLASSIFICATION OF SUBJECT MATTER

IPC7: G01F 1/28, B03B 13/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: G01F, B03D, B03B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2033306 A (E. R. SCHOFIELD), 10 March 1936 (10.03.36), see column 2, line 48 - column 3, line 56; figures 1-6 --	1-4,6-9
X	US 2896453 A (A. J. RYAN ET AL), 28 July 1959 (28.07.59), see column 3, line 8 - line 57; column 4, line 13 - line 42; figure 1 --	1-4,6,8
X	US 3914994 A (PHILIP M. BANNER), 28 October 1975 (28.10.75), see column 4, line 49 - column 5, line 9; abstract; figur 3 --	1-6

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier document but published on or after the international filing date	"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

12 October 2000

Date of mailing of the international search report

16 -10- 2000

Name and mailing address of the ISA/  
 Swedish Patent Office  
 Box 5055, S-102 42 STOCKHOLM  
 Facsimile No. +46 8 666 02 86

Authorized officer

Gunnel Wästerlid/Eö  
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# INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 00/00553

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4133746 A (GAYLORD W. DOPSON), 9 January 1979 (09.01.79), see column 5, line 7 - line 39; abstract  -- -----	1-9

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/FI 00/00553

Patent document cited in search report			Publication date	Patent family member(s)	Publication date
US	2033306	A	10/03/36	NONE	
US	2896453	A	28/07/59	NONE	
US	3914994	A	28/10/75	US 3793997 A	26/02/74
US	4133746	A	09/01/79	NONE	

# PATENT COOPERATION TREATY

WO 01/01080  
PCT/FI00/00553

PCT

## NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF THE INTERNATIONAL APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

From the INTERNATIONAL BUREAU

To:

OUTOKUMPU OYJ  
Intellectual Property Management  
P.O. Box 27  
FIN-02201 Espoo  
FINLANDE

Received

*Telus*

15.01.01

outokumpu

Date of mailing (day/month/year)

04 January 2001 (04.01.01)

Applicant's or agent's file reference

991484 WO

### IMPORTANT NOTICE

International application No.

PCT/FI00/00553

International filing date (day/month/year)

20 June 2000 (20.06.00)

Priority date (day/month/year)

29 June 1999 (29.06.99)

Applicant

OUTOKUMPU OYJ et al

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:

AU, KP, KR, US

In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:

AE, AL, AM, AT, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EA, EE, EP, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZA, ZW

The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on

04 January 2001 (04.01.01) under No. WO 01/01080

### REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a demand for international preliminary examination must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

### REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the national phase, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

The International Bureau of WIPO  
34, chemin des Colombettes  
1211 Geneva 20, Switzerland

Authorized officer

J. Zahra

Facsimile No. (41-22) 740.14.35

Telephone No. (41-22) 338.83.38

# PATENT COOPERATION TREATY

**PCT**

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner  
US Department of Commerce  
United States Patent and Trademark  
Office, PCT  
2011 South Clark Place Room  
CP2/5C24  
Arlington, VA 22202  
ETATS-UNIS D'AMERIQUE  
in its capacity as elected Office

Date of mailing (day/month/year) 07 March 2001 (07.03.01)	Applicant's or agent's file reference 991484 WO
International application No. PCT/FI00/00553	Priority date (day/month/year) 29 June 1999 (29.06.99)
International filing date (day/month/year) 20 June 2000 (20.06.00)	
Applicant SAASTAMOINEN, Eljas et al	

1. The designated Office is hereby notified of its election made:



in the demand filed with the International Preliminary Examining Authority on:

26 January 2001 (26.01.01)



in a notice effecting later election filed with the International Bureau on:

2. The election



was



- was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer R. E. Stoffel Telephone No.: (41-22) 338.83.38
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Form PCT/IB/331 (July 1992)

FI0000553

# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference <b>991484 WO</b>	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. <b>PCT/FI00/00553</b>	International filing date ( <i>day month year</i> ) <b>20-6-2000</b>	Priority date ( <i>day month year</i> ) <b>29-06-1999</b>
International Patent Classification (IPC) or national classification and IPC <b>G01F 1/28, B03B 13/00</b>		
Applicant <b>OUTOKUMPU OYJ ET AL</b>		

<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of <u>4</u> sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of <u>2</u> sheets.</p> <p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> <li>I <input checked="" type="checkbox"/> Basis of the report</li> <li>II <input type="checkbox"/> Priority</li> <li>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</li> <li>IV <input type="checkbox"/> Lack of unity of invention</li> <li>V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</li> <li>VI <input type="checkbox"/> Certain documents cited</li> <li>VII <input type="checkbox"/> Certain defects in the international application</li> <li>VIII <input type="checkbox"/> Certain observations on the international application</li> </ul>
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Date of submission of the demand  <b>26-01-2001</b>	Date of completion of this report  <b>21-08-2001</b>
Name and mailing address of the IPEA/SE Patent- och registreringsverket      Telefon: 17970 Box 5055      FAX: 08-782 25 00 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer  <b>Gordana Nincovic /itw</b> Telephone No. 08-782 25 00



# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International Application No.

PCT/FI00/00553

## I. Basis of the report

### 1. With regard to the elements of the international application:\*

- ☐ the international application as originally filed
- ☒ the description:  
 pages 1-5, as originally filed  
 pages \_\_\_\_\_, filed with the demand  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_
- ☒ the claims:  
 pages \_\_\_\_\_, as originally filed  
 pages \_\_\_\_\_, as amended (together with any statement) under article 19  
 pages \_\_\_\_\_, filed with the demand  
 pages 7-8, filed with the letter of 31-05-2001
- ☒ the drawings:  
 pages 1-2, as originally filed  
 pages \_\_\_\_\_, filed with the demand  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_
- ☐ the sequence listing part of the description:  
 pages \_\_\_\_\_, as originally filed  
 pages \_\_\_\_\_, filed with the demand  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

### 2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item. These elements were available or furnished to this Authority in the following language \_\_\_\_\_ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

### 3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

### 4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, Nos. \_\_\_\_\_
- ☐ the drawings, sheet/fig \_\_\_\_\_

### 5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).\*\*

\* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

\*\* Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International Application No.

PCT/FI00/00553

## V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

### 1. Statement

Novelty (N)	Claims	<u>1-9</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-9</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-9</u>	YES
	Claims		NO

### 2. Citations and explanations (Rule 70.7)

The present invention relates to an arrangement for measuring concentrate flow in connection with a flotation cell, in which flow the slurry and the liquid, having different densities, are at least partly in layers. The arrangement comprises an elongated sensor element extending essentially over the whole transversal area of the material flow to be measured and a measuring device for detecting the position of the sensor element.

Documents cited in the International Search Report:

- D1 US 2033306 A (E.R.Schofield), 10 March 1936
- D2 US 2896453 A (A.J.Ryan et al), 28 July 1959
- D3 US 3914994 A (P.M.Banner), 28 October 1975
- D4 US 4133746 A (G.W.Dopson), 9 January 1979

Each of documents D1 - D3 discloses a liquid flow device for determining the liquid flow condition of a fluid system comprising an elongated sensor body mounted over the whole transversal area of the liquid flow to swing about the horizontal axis of a measuring means arranged for detecting the angular motion of the sensor body. The device comprises also a control and indicating means for presenting condition of the fluid system. (See doc. D1: column 2, line 48 - column 3, line 56, fig. 1-6; doc. D2: column 3, line 8 - 57, column 4, line 13 - 42, fig. 1; doc. D3: column 4, line 49 - column 5, line 9, abstract, fig. 3).

Document D4 discloses a system and a method for controlling froth flotation by adjusting air feed according to variations in mass flow of concentrate overflow. (See abstract).

... / ...

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International Publication No.

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**Supplemental Box**

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: V

However, none of the cited documents discloses an arrangement for measuring concentrate flow in connection with a flotation cell, solving the problem of measuring concentrate flow of two materials having essentially different densities and being at least partly in layers.

In view of the cited documents such an arrangement cannot be considered obvious to a person skilled in the art.

Therefore the invention claimed in claims 1 - 9 is novel and considered to involve an inventive step.

The invention is considered to be industrially applicable.

# CLAIMS

1. An arrangement for measuring concentrate flow in connection with a flotation cell, in which flow the slurry and liquid, formed of the foam of flotation  
5 cell and having different densities, are at least partly in layers, **characterized** in that said arrangement comprises an elongate sensor element (1) extending essentially over the whole transversal area of the material flow to be measured, and a measuring device (2) for detecting the position of the sensor element (1).
- 10 2. An arrangement according to claim 1, **characterized** in that the measuring device (2) is an angle transmitter.
3. An apparatus according to claim 1 or 2, **characterized** in that the sensor  
15 element (1) is attached to the horizontal axis (3) of the measuring device (2).
4. An apparatus according to any of the preceding claims 1 - 3, **characterized** in that the horizontal axis (3) of the measuring device (2) is positioned essentially transversally to the flowing direction of the concentrate flow to be  
20 measured.
5. An apparatus according to any of the preceding claims 1 - 4, **characterized** in that the arrangement is connected to the control system (6) of the flotation cell.
- 25 6. An apparatus according to any of the preceding claims 1 - 5, **characterized** in that the arrangement comprises a display unit (7).
7. An apparatus according to any of the preceding claims 1 - 6, **characterized**  
30 in that the concentrate flow to be measured is the flow (13) flowing out of a flotation cell via a drain chute (8).

8. An apparatus according to any of the preceding claims 1 - 7, **characterized** in that in the sensor element (1), there is arranged a calibration means (4), such as a movable weight.

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9. An apparatus according to any of the preceding claims 1 - 8, **characterized** in that the arrangement is provided in connection with the drain chute (8) of a flotation cell (11), preferably so that the sensor element (1) is at least partly placed in a collecting pipe (10).

10